

# CLAIMS

1. A photo-curable fluorine-containing resin composition comprising:

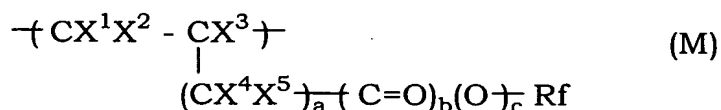
- 5 (a) a curable fluorine-containing polymer (I) having a number average molecular weight of from 500 to 1,000,000 and represented by the formula (1):



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wherein the structural unit M is a structural unit derived from a fluorine-containing ethylenic monomer and represented by the formula (M):

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wherein  $X^1$  and  $X^2$  are the same or different and each is H or F;  $X^3$  is H, F,  $\text{CH}_3$  or  $\text{CF}_3$ ;  $X^4$  and  $X^5$  are the same or different and each is H, F or  $\text{CF}_3$ ; Rf is an organic group in which 1 to 3  $Y^1$  ( $Y^1$  is a monovalent organic group which has 2 to 100 carbon atoms and 1 to 5 crosslinkable cyclic ether structures in which hydrogen atoms may be substituted with fluorine atoms) are bonded to a fluorine-containing alkyl group having 1 to 40 carbon atoms or a fluorine-containing alkyl group having 2 to 100 carbon atoms and ether bond; a is 0 or an integer of from 1 to 3; b and c are the same or different and each is 0 or 1,

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the structural unit A is a structural unit derived from a monomer

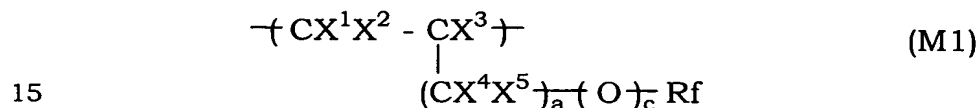
copolymerizable with the fluorine-containing ethylenic monomer for the structural unit represented by said formula (M),

said structural unit M and said structural unit A being contained in amounts of from 0.1 to 100 % by mole and from 0 to 99.9 % by mole,

5 respectively, and

(b) a photoacid generator (II).

2. The composition of Claim 1, wherein the curable fluorine-containing polymer (I) is the fluorine-containing polymer of the formula  
10 (1), in which the structural unit M is a structural unit M1 derived from a fluorine-containing ethylenic monomer and represented by the formula (M1):

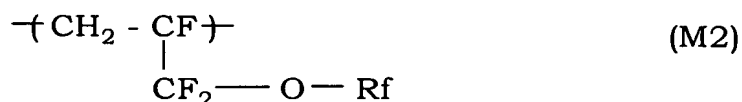


wherein  $X^1$  and  $X^2$  are the same or different and each is H or F;  $X^3$  is H, F,  $\text{CH}_3$  or  $\text{CF}_3$ ;  $X^4$  and  $X^5$  are the same or different and each is H, F or  $\text{CF}_3$ ; Rf is an organic group in which 1 to 3  $\text{Y}^1$  ( $\text{Y}^1$  is a monovalent organic  
20 group which has 2 to 100 carbon atoms and 1 to 5 crosslinkable cyclic ether structures in which hydrogen atoms may be substituted with fluorine atoms) are bonded to a fluorine-containing alkyl group having 1 to 40 carbon atoms or a fluorine-containing alkyl group having 2 to 100 carbon atoms and ether bond; a is 0 or an integer of from 1 to 3; c is 0 or  
25 1.

3. The composition of Claim 1, wherein the fluorine-

containing polymer (I) is the fluorine-containing polymer of the formula (1), in which the structural unit M is a structural unit M2 derived from a fluorine-containing ethylenic monomer and represented by the formula (M2):

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wherein Rf is an organic group in which 1 to 3 Y<sup>1</sup> (Y<sup>1</sup> is a monovalent organic group which has 2 to 100 carbon atoms and 1 to 5 crosslinkable cyclic ether structures in which hydrogen atoms may be substituted with fluorine atoms) are bonded to a fluorine-containing alkyl group having 1 to 40 carbon atoms or a fluorine-containing alkyl group having 2 to 100 carbon atoms and ether bond.

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4. The composition of Claim 1, wherein the fluorine-containing polymer (I) is the fluorine-containing polymer of the formula (1), in which the structural unit M is a structural unit M3 derived from a fluorine-containing ethylenic monomer and represented by the formula (M3):

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wherein Rf is an organic group in which 1 to 3 Y<sup>1</sup> (Y<sup>1</sup> is a monovalent organic group which has 2 to 100 carbon atoms and 1 to 5 crosslinkable cyclic ether structures in which hydrogen atoms may be substituted

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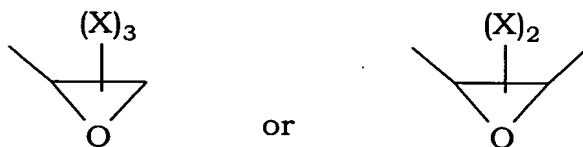
5                    5. The composition of any of Claims 1 to 4, wherein at least one of Y<sup>1</sup> in Rf in said formulae (M), (M1), (M2) and (M3) is bonded to an end of Rf.

6. The composition of any of Claims 1 to 4, wherein Y<sup>1</sup> in Rf in  
10 said formulae (M), (M1), (M2) and (M3) is a monovalent organic group  
which has 2 to 100 carbon atoms and 1 to 5 crosslinkable cyclic ether  
structures of 3- to 6-membered ring having at least one ether bond, in  
which hydrogen atom of the cyclic ether structure may be substituted  
with fluorine atom.

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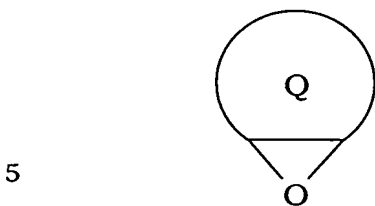
7. The composition of any of Claims 1 to 4, wherein Y<sup>1</sup> in Rf in said formulae (M), (M1), (M2) and (M3) is an organic group having 2 to 100 carbon atoms and 1 to 5 oxirane structures which are crosslinkable cyclic ether structures of 3-membered ring and are represented by:

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wherein X are the same or different and each is a hydrogen atom, a  
25 fluorine atom, an alkyl group having 1 to 6 carbon atoms or a fluorine-  
containing alkyl group having 1 to 6 carbon atoms, or  
an organic group having 3 to 100 carbon atoms and 1 to 5 structures

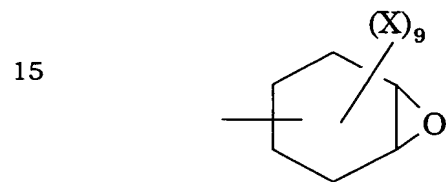
represented by:



wherein Q is a monovalent or divalent organic group of monocyclic, polycyclic or heterocyclic structure having 3 to 100 carbon atoms, in which hydrogen atom of Q may be substituted with said X.

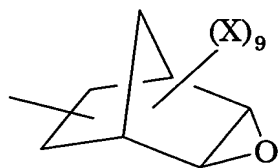
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8. The composition of any of Claims 1 to 4, wherein  $Y^1$  in Rf in said formulae (M), (M1), (M2) and (M3) is an organic group which has 6 to 100 carbon atoms and 1 to 5 structures represented by:



wherein X is as defined above, or an organic group which has 7 to 100 carbon atoms and 1 to 5 structures represented by:

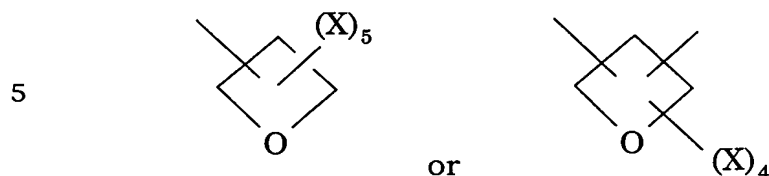
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25 wherein X is as defined above.

9. The composition of any of Claims 1 to 4, wherein  $Y^1$  in Rf in

said formulae (M), (M1), (M2) and (M3) is an organic group which has 3 to 100 carbon atoms and 1 to 5 oxetane structures represented by:



wherein X are the same or different and each is hydrogen atom, fluorine atom, an alkyl group having 1 to 6 carbon atoms or a fluorine-containing alkyl group having 1 to 6 carbon atoms.

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10. The composition of any of Claims 1 to 9, wherein a fluorine content of the curable fluorine-containing polymer (I) is not less than 40 % by weight.

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11. The composition of any of Claims 1 to 10, wherein the photoacid generator (II) is at least one aromatic compound selected from the group consisting of aromatic diazonium salts, aromatic sulfonium salts, aromatic iodonium salts and metallocene compounds.

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12. The composition of any of Claims 1 to 11, wherein the photoacid generator (II) is at least one aromatic compound selected from the group consisting of aromatic diazonium salts, aromatic sulfonium salts, aromatic iodonium salts and metallocene compounds, in which 1 to 4 organic groups R are bonded to the aromatic ring, wherein R are the same or different and each is hydroxyl group, thioalkyl group, thiophenoxy group or an alkyl group having 1 to 10 carbon atoms which

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may have ether bond.

13. The composition of any of Claims 1 to 12, wherein the photoacid generator (II) is a compound having fluorine atom.

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14. A cured article obtained by curing the composition of any of Claims 1 to 13.

15. A cured article obtained by photo-curing the composition  
10 of any of Claims 1 to 13.

16. An optical material for optical devices which comprises the curable fluorine-containing polymer (I) of any of Claims 1 to 10.

15 17. An optical material for optical devices which comprises the photo-curable fluorine-containing resin composition of any of Claims 1 to 13.

18. An optical member for optical devices which is obtained  
20 from a cured article made by curing the optical material for optical devices of Claim 16 or 17.

19. A material for optical waveguide which is obtained from the optical material for optical devices of Claim 16 or 17.

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20. A member for optical waveguide which is obtained from a cured article made by curing the material for optical waveguide of Claim

19.

21. A material for a sealing member for optical devices which is obtained from the optical material for optical devices of Claim 16 or

5 17.

22. An optical device having a sealing member which is obtained from a cured article made by curing the material for a sealing member of Claim 21.

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23. An optical material for display devices which comprises the curable fluorine-containing polymer (I) of any of Claims 1 to 10.

24. An optical material for display devices which comprises  
15 the photo-curable fluorine-containing resin composition of any of Claims 1 to 13.

25. An optical member for display devices which is obtained from a cured article made by curing the optical material for display  
20 devices of Claim 23 or 24.

26. A material for an antireflection film which comprises the optical material for display devices of Claim 23 or 24.

25 27. An antireflection film obtained by curing the material for an antireflection film of Claim 26.

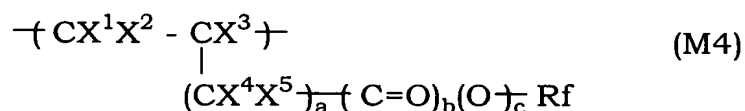


28. A fluorine-containing polymer having crosslinkable group which has a number average molecular weight of from 500 to 1,000,000 and is represented by the formula (2):

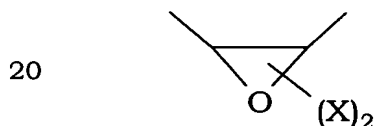
5                    - (M4) - (B) -                    (2)

wherein the structural unit M4 is a structural unit derived from a fluorine-containing ethylenic monomer and represented by the formula (M4):

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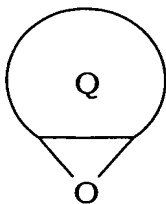


wherein  $X^1$  and  $X^2$  are the same or different and each is H or F;  $X^3$  is H,  
 15 F,  $CH_3$  or  $CF_3$ ;  $X^4$  and  $X^5$  are the same or different and each is H, F or  
 $CF_3$ ; Rf is an organic group in which 1 to 3  $Y^2$  ( $Y^2$  is an organic group  
 having 2 to 100 carbon atoms and 1 to 5 crosslinkable cyclic ether  
 structures of:



wherein X are the same or different and each is hydrogen atom, fluorine atom, an alkyl group having 1 to 6 carbon atoms or a fluorine-containing alkyl group having 1 to 6 carbon atoms, or

25 an organic group having 3 to 100 carbon atoms and 1 to 5 structures represented by the formula:

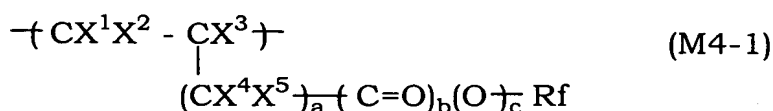


- 5 wherein Q is a monovalent or divalent organic group of monocyclic, polycyclic or heterocyclic structure having 3 to 100 carbon atoms in which hydrogen atom of Q may be substituted with said X) are bonded to a fluorine-containing alkyl group having 1 to 40 carbon atoms or a fluorine-containing alkyl group having 2 to 100 carbon atoms and ether
- 10 bond; a is 0 or an integer of from 1 to 3; b and c are the same or different and each is 0 or 1,
- the structural unit B is a structural unit derived from a monomer copolymerizable with the fluorine-containing ethylenic monomer for the structural unit of said formula (M4),
- 15 said structural unit M4 and said structural unit B being contained in amounts of from 0.1 to 100 % by mole and from 0 to 99.9 % by mole, respectively.

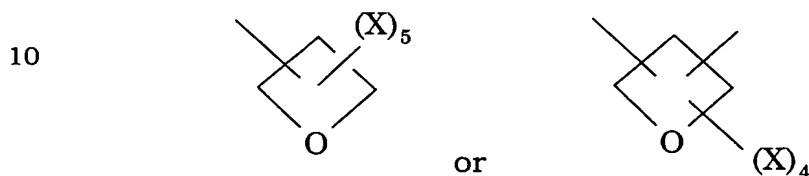
29. A fluorine-containing polymer having crosslinkable group
- 20 which has a number average molecular weight of from 500 to 1,000,000 and is represented by the formula (2-1):



- 25 wherein the structural unit M4 is a structural unit derived from a fluorine-containing ethylenic monomer and represented by the formula (M4-1):



wherein  $X^1$  and  $X^2$  are the same or different and each is H or F;  $X^3$  is H, F,  $\text{CH}_3$  or  $\text{CF}_3$ ;  $X^4$  and  $X^5$  are the same or different and each is H, F or  $\text{CF}_3$ ; Rf is an organic group in which 1 to 3  $Y^{2a}$  ( $Y^{2a}$  is an organic group having 3 to 100 carbon atoms and 1 to 5 crosslinkable cyclic ether structures of:



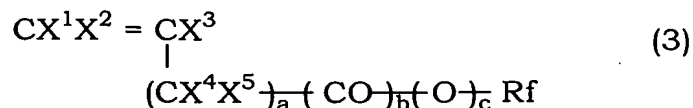
wherein X are the same or different and each is hydrogen atom, fluorine atom, an alkyl group having 1 to 6 carbon atoms or a fluorine-containing alkyl group having 1 to 6 carbon atoms) are bonded to a fluorine-containing alkyl group having 1 to 40 carbon atoms or a fluorine-containing alkyl group having 2 to 100 carbon atoms and ether bond; a is 0 or an integer of from 1 to 3; b and c are the same or different and each is 0 or 1,

20 the structural unit B is a structural unit derived from a monomer copolymerizable with the fluorine-containing ethylenic monomer for the structural unit of said formula (M4-1),

said structural unit M4 and said structural unit B being contained in amounts of from 0.1 to 100 % by mole and from 0 to 99.9 % by mole, respectively.

30. A fluorine-containing ethylenic monomer represented by

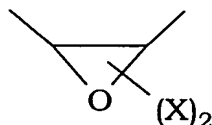
the formula (3):



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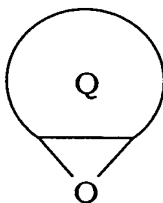
wherein  $\text{X}^1$  and  $\text{X}^2$  are the same or different and each is H or F;  $\text{X}^3$  is H, F,  $\text{CH}_3$  or  $\text{CF}_3$ ;  $\text{X}^4$  and  $\text{X}^5$  are the same or different and each is H, F or  $\text{CF}_3$ ; Rf is an organic group in which 1 to 3  $\text{Y}^2$  ( $\text{Y}^2$  is an organic group having 2 to 100 carbon atoms and 1 to 5 crosslinkable cyclic ether

10 structures of:



wherein X are the same or different and each is hydrogen atom, fluorine atom, an alkyl group having 1 to 6 carbon atoms or a fluorine-containing alkyl group having 1 to 6 carbon atoms, or an organic group having 3 to 100 carbon atoms and 1 to 5 structures represented by the formula:

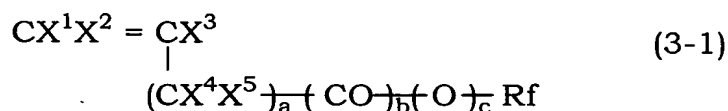
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wherein Q is a monovalent or divalent organic group of monocyclic, polycyclic or heterocyclic structure having 3 to 100 carbon atoms in which hydrogen atom of Q may be substituted with said X) are bonded to a fluorine-containing alkyl group having 1 to 40 carbon atoms or a fluorine-containing alkyl group having 2 to 100 carbon atoms and ether

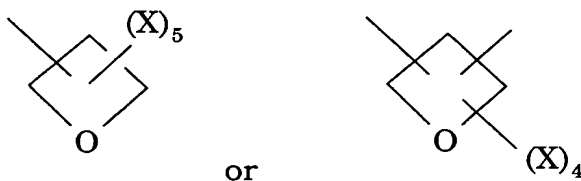
bond; a is 0 or an integer of from 1 to 3; b and c are the same or different and each is 0 or 1

31. A fluorine-containing ethylenic monomer represented by  
5 the formula (3-1):



10 wherein  $\text{X}^1$  and  $\text{X}^2$  are the same or different and each is H or F;  $\text{X}^3$  is H, F,  $\text{CH}_3$  or  $\text{CF}_3$ ;  $\text{X}^4$  and  $\text{X}^5$  are the same or different and each is H, F or  $\text{CF}_3$ ; Rf is an organic group in which 1 to 3  $\text{Y}^{2a}$  ( $\text{Y}^{2a}$  is an organic group having 2 to 100 carbon atoms and 1 to 5 crosslinkable cyclic ether structures of:

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wherein X are the same or different and each is hydrogen atom, fluorine  
20 atom, an alkyl group having 1 to 6 carbon atoms or a fluorine-containing alkyl group having 1 to 6 carbon atoms) are bonded to a fluorine-containing alkyl group having 1 to 40 carbon atoms or a fluorine-containing alkyl group having 2 to 100 carbon atoms and ether bond; a is 0 or an integer of from 1 to 3; b and c are the same or different and  
25 each is 0 or 1.